live hedges should be left standing for a year or two more; live hedges, however, should be destroyed at once as the risk of their growing into rank jungle and injuring the tree is too great to be run.

CHAPTER XI

Management of Avenues

(1) Pruning

General

1. The most important part of this management, after the trees have become self-supporting, will consist of pruning. Thinning will rarely be required as the maintenance of trees at the road side is usually so costly that no more will be planted than are wanted for the avenue.

Pruning

2. The object of pruning is to obtain a shapely healthy tree with shade not over-thick. It should begin in the nursery and continue almost to the end of the life of the tree. It has, therefore, been thought best to deal with it as a whole in this place.

Since the tree must not interfere with the traffic on the road it must have a clear stem free from branches for a certain height from the ground. This height will vary with the conditions and is sometimes given as 8 to 10 feet. If the branches grow horizontally it may be necessary to shorten some of these. But the height of 11 feet to the first branch should not be exceeded. Keeping this height from the ground clear of branches helps the drying of the road after rain and thus reduces to some extent the wear of the road surface.

Forming straight boles in young road-side trees

3. The smaller the branches are when pruned, the less the harm done. The natural tendency of many trees, notably the firs and pines, is to grow with a straight stem and regular conical crown. Other trees, including most of the broad-leaf trees, are most irregular in their growth and naturally have many trunks, or great lateral branches. By the judicious pruning

while young and small, of the lower branches, isolated trees growing along roads may be given tall, straight stems, as if they had been grown in close contact with other trees in a well managed forests.

4. To obtain these conditions, the trees should be pruned while young. The terminal buds of any secondary leading shoots that appear should be pinched off at once ; and the lowest lateral branches should be pruned off each year while they are still small. If the top is weak or broken, it may be cut off and one of the side branches allowed to take the lead.

5. Not more than about two rows or tiers of branches should be removed in one year. If too many of the branches are removed, the health of the tree suffers ; it becomes top heavy and has to be supported. Nor ought the pruning to be commenced too soon before the tree is advanced enough to stand such treatment. The leaves of the branches perform the function of manufacturing nutriment for the tree and their removal too early, or too many at a time, causes the growth of spindly weak stem. In addition the strong sun, falling on young bark, especially if wet, causes it to burn or toughen and the tree consequently becomes hide-bound. The age at which pruning should be commenced and the amount to be pruned depend primarily on the rapidity and vigour of the growth. The regular stems seen in the avenues of European cities are formed by keeping the lower branches pruned while the young trees are still in the nursery. Such trees rarely require much pruning in after-life.

6. Pruning at the road-side will follow the same lines until the stem is clear of branches for the desired height from the ground. After that, except for the removal of broken branches, the pruning will consist of removing superfluous branches with a view to keeping the tree shapely, to prevent it from obstructing the traffic, to reduce the shade when desirable in the interest of economical road maintenance, and sometimes to rid the trees of certain fungus diseases or insect pests.

Axes not to be used in pruning

7. The pruning of road-side trees in this country is generally done by a coolie climbing the tree and hacking off the branch it is wished to remove at six inches or a foot from the stem leaving a jagged, unsightly stump. These snags rot and bring about the quick decay of the tree. All this is avoided by using the saw instead of the axe and by cutting of the branches smoothly

flush with the stem. Such wounds soon heal and become covered with bark. When cutting back lateral branches always cut at a fork. Valuable timber trees are constantly hacked to admit a free circulation of the air, as it is called, and are in consequence rendered useless, except for firewood. There are few stations or road-side avenues where such eye-sores are not to be found. The use of the axe by coolies should be strictly prohibited. Pruning could be done with an axe if sufficient care were taken. But this care is never taken, and the only possible way to prevent hacking is not to allow axes to be used.

8. All prunings should, therefore, be done with the saw or good sharp steel instruments. Small branches or twigs should be cut with a sharp pruning knife, larger branches with the saw or pruning chisel. In removing a large branch first cut through the bark all round with the pruning knife or chisel ; then saw it off roughly about a foot from the trunk, cutting the under side first and afterwards the upper a few inches further from the trunk, and finally saw off the stump : or the pruning chisel may be used first to cut all round the branch before using the saw. In this way there will be no tearing of the bark. After the branch has been removed, any jagged ends left should be pared smooth with the pruning knife, and then the whole cut should be painted over with tar. The cut, where possible, should be vertical, or slant downwards, so that the rain water may not lodge on it or get into the stem through the wound. Where the wound is necessarily large, it should always be covered with tar to protect it against moisture and decay.

Season for pruning

9. The end of the cold weather, just before the leaves appear, when growth is least active, is the best season for pruning, as the wounds are then left exposed for the shortest time possible. If done during winter, they remain uncovered too long ; if during the warm weather, when the trees are in full growth, the wounds bleed, and tar, if used, will not adhere to them.

(2) LOPPING

Lopping

10. Lopping, by which is meant cutting of the branches only, should be done carefully and extremely moderately when it is necessary (*a*) for promoting growth of the trees or (*b*) for

improving the symmetry and beauty of an avenue, or (*c*) for keeping the tree shapely or (*d*) for preventing the branches from obstructing the traffic, or (*e*) for getting the tree rid of certain fungus diseases or insect pests. It is also desirable in the interest of economical road maintenance to reduce the overhanging branches of trees, but the necessary check should be exercised on the lopping done for this purpose so as not, virtually, to spoil the trees or at any rate to create the most inaesthetic effort. Proper season for lopping is the winter, when the sap is down.

(3) Tree Surgery

11. The tree becomes prey to many enemies. These include the untrained worker who prunes the tree or lops the branches for any *bona fide* purpose. The storms, and cyclones also play their part and damage trees in many ways. The insect pests and diseases also get hold of the open wounds on trees and settle down comfortably to breed or multiply.

12. The tree injury has to be dressed in time to prevent this rot which destroys the tree completely in the long run, and also spreads infection to other likely places in an avenue or stray trees.

13. There are two established methods of treatment. One is preventive and the other is curative. The preventive measures consists of cutting the branches or broken limbs with a sharp saw or chisel, flush with the main limb, and dress the cut portion with tar or paint or any other wood preservative. While cutting the unwanted branches, care must be taken to take a primary cut one or two inches deep in the bark on the lower side of the branch or stump which is required to be cut. This prevents peeling or tearing of the lower bark on the limb before it is completely removed. The irregular longitudinal slits in the lower bark sometimes extend down below and injure the main trunk also.

14. In the curative process the rotting limb has to be further pruned or scrapped till live cambium layer and fresh wood are obtained. Then if there is a cavity, it has to be filled up with asphalt, cement mortar, bricks or even stone masonry after disinfecting the fresh portion of the newly made wound. The nature of filling material usually depends on the magnitude, suitability of operation and availability of the materials.

15. The ultimate object in both the above mentioned processes is to help the natural formation of bark and callus over the wound wherever feasible by preventing the wound from rotting due to one cause or the other, and weaken the tree, and also to support the weakened limbs by artificial reinforcement.

16. The typical injuries and methods employed to heal or cure them are illustrated, *vide* plate IV.

17. A watch must be kept over the established avenues, particularly in the neighbourhood of towns to see that branches are not being cut for fodder by camel drivers or goat herds. Trees suffer serious injury owing to the repeated stripping of leaves and young branches that results when the people are allowed to make a free use of them.

(4) Realisation of Income

Source of income

18. The income credited to arboriculture is derived from the following heads :—

(1) sale of fallen trees ;

(2) sale of loppings ;

(3) sale of annual produce of trees ;

(4) sale of road-side grass ;

(5) miscellaneous.

As a general rule whatever has to be sold should be sold by auction.

Lopping

19. Lopping should never be done by the purchaser, as it is hopeless to expect that the work would be properly executed. The superfluous branches must be cut by the men employed on the avenues, and then sold.

Grass

20. The grass on all roads is in some Provinces sold for the benefit of arboriculture, whether there are avenues on the roads or not. Care must be taken that the grass does not fall into the hands of persons who will use their position to levy blackmail on the owners of cattle traversing the road.

Special care is needed on this point in localities where the supply of grazing is so large that there is little demand for the road-side grass. In these cases it may even be better not to sell the grass at all; but where the demand for grass is great, sales should invariably be made as otherwise the unrestricted grazing is likely to result in serious injury to the trees.

Conditions of sale of grass

21. Contracts for the sale of grass must provide (1) that the grass shall either be cut with a sickle or grazed off the road and that the khurpi must not be used; (2) that the contractor is responsible for all damage caused by animals to trees on the roads which he has taken. Where the roads have young trees a penalty of a reasonable sum, as liquidated damages, should be fixed for each tree destroyed during the period of the contract.

CHAPTER XII

GROVES

Encamping grounds

1. Shade should be provided as far as possible on encamping grounds, especially on the roads where there is a large pilgrim traffic. The system of planting should be generally similar to that indicated for avenues, except that as many lines should be planted as there is room for, and that the lines should be the same distance apart as the trees in the line. Trees giving thick shade should be preferred, but the tamarind should not be planted in ordinary circumstances as there is a prejudice against sleeping under it.

Groves on barren roads

2. Endeavours should be made to plant groves of trees at intervals along lengths of road where the soil is barren and avenues cannot be expected to succeed. The need of shade is greater on these roads than anywhere else. The least barren patches of ground on the roadside should be picked out with the assistance of practical cultivators living in the neighbourhood; the presence of Hariali grass almost always indicates a patch of better land. Where a patch appears to be suitable, a hole